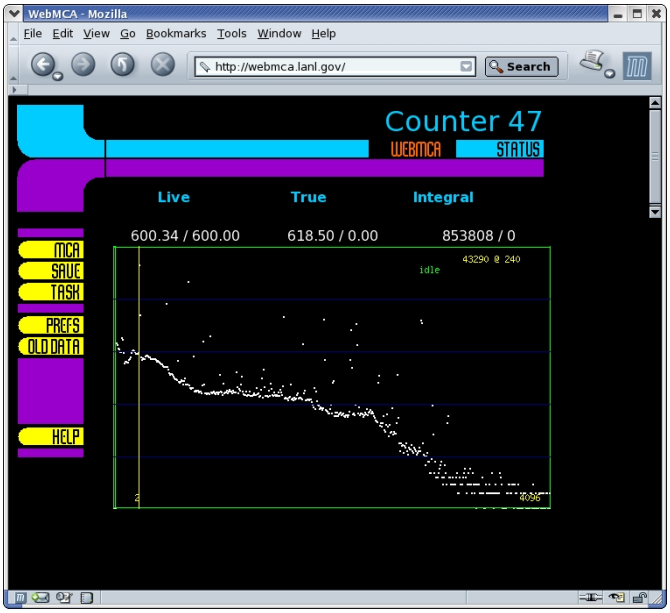
WebMCA
Overview



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Introduction

The WebMCA (US Patent 6,668,277) is a web-based Multi-Channel Analyzer for nuclear spectroscopy data acquisition. The WebMCA combines recent advances in Internet technologies, embedded computer platforms, and open-source software to construct an MCA with standard Internet interfaces. The unit is inexpensive, compact, flexible and upgradeable. We are actively pursuing commercialization of the technology.

This unit is the result of research conducted by members of the Nuclear and Radiochemistry Group at Los Alamos National Laboratory.

Feature Summary

- Compact (fits in a double-wide NIM module or less), non-NIM versions planned
- Embedded computer running Linux
- Internet interfaces include web server, FTP client/server, email, telnet, network socket
- Interfaces to a wide variety of external ADCs using software modules
- Capable of supporting mixer/routers
- Capable of supporting internal data conversion units (ADCs, DSPs, etc)
- Standard PC-104 bus for other interface needs
- On-board network interface, VGA/keyboard or Flat panel, COM and LPT ports
- High reliability - no rotating media
- Open platform supporting easy software customization

Technical description

The WebMCA consists of a standard single board computer, running the Linux operating system, with added hardware (currently a standard commercial IO card) to provide an interface to an external analog to digital convertor (ADC) or an on-board ADC. A custom-written kernel level software module responds (on an interrupt driven basis) to pulses acquired and digitized by the ADC and stores it in a kernel-level histogram memory buffer. The kernel module provides both a standard character device interface and a procfs interface, facilitating easy control and data accessibility to a user-level program.

The user space programs provide the high-level control functions typically needed for a pulse-height or multi-channel analyzer, including memory range control (number of channels), start and stop collect, clear data, etc. This user-level program can be a collection of CGI programs, or a stand-alone application that accepts network socket connections and can thus be controlled via standard network aware applications such as telnet. The control function also provides the capability to stream raw data via an Internet (TCP/IP) connection as well, allowing multiple remote applications to receive the data stream.

On demand the histogram data is converted to graphical format (a PNG image) and served as part of an HTML page, viewable using any standard Internet web browser. The web server is also capable of posting a form-based web page for stand alone configuration and counting description, such that an entire data-acquisition cycle can be configured, completed, and viewed via the web, using a web browser. By using standard web techniques, the data can be made available directly into spread-sheet applications, or can be viewed live using streaming techniques.

The interface software also supports other standard Internet technologies, such as the file transfer protocol (FTP) for retrieving data, and email. One possible disposition of the data would be to email the final spectral data to a chosen location at completion of the data acquisition cycle.

Since standard UNIX and web / Internet technologies are used, end users have the ability to highly customize the Web-MCA, using any of a variety of high level languages, including PERL, C, HTML, JAVA, and shell scripts.

Advantages / improvements

The WebMCA is a significant leap forward compared with previous technologies, in that it establishes as its interface, those techniques and technologies in normal use over the Internet. By providing a web-based interface, any computer literally anywhere in the world is capable of accessing the WebMCA, with no special software, other than a standard web browser.

By using standard network socket and other standard communication protocols (like FTP) any of a wide variety of applications can interface to and communicate with WebMCAs. Also, given that the WebMCA is an open architecture, based on open-source software, it lends itself to easy customization and modification by end users.

Software

The software is divided into two primary subsections, one that resides at the Operating System's kernel level as a loadable kernel module, and one that resides in the user space as a standard application. The kernel level module provides a standard character special device interface and a procfs interface to the user level, allowing other user level programs to be easily developed and implemented.

The WebMCA development design goal was to support count rates up to 10,000 counts/second. In testing, the WebMCA was evaluated at count rates ranging from a few hundred counts/second to around 15,000 counts/second. In it's current configuration, a theoretical count rate limit would be 50,000 counts/second. At 15,000 counts per second the interactive (web interface) performance is still quite reasonable, although at count rates approaching 40,000 to 50,000 counts per second the kernel would require essentially all of the available CPU time. However, the results are for an outdated CPU (133 MHz 486), so the attainable performance capabilities are significantly higher.

Further Development

Further development of the WebMCA system may include the following::

Operating System / Platform:
Enhance Internet security
Add log rotation, /var file cleanup, and self maintenance for long up-times. (done)
Support for PERL or TCL or other scripting language

Kernel Driver:.
Modify for other ADCs (8077, ND58x, etc).

Web Interface:
Improve structure of CGI scripts
Develop a non NG standard web interface design.
Add live image / streaming capability

Other software:
Add local display and control capability
Local peak searching, FWHM, standard IO formats..
API for customization.

Hardware
Repackage
USB support
Internal ADC, including DSP

Commercialization
US Patent 6,668,277 ("Web-based Multi-Channel Analyzer") has issued
Seek commercial partner for continued development and commercialization.
Jointly develop final product specifications and feature matrix.
LANL Tasks: Platform (OS), kernel modules, API, LANL specific web functions, deployment testing.
Partner Tasks: Standard web interface, hardware (including internal ADC), local display code and other feature code (peak search, etc), compatibility code.